

## COMPARATIVE ANALYSIS OF SKI TRAIL RATING IN SERRA DA ESTRELA (PORTUGAL) AND SIERRA NEVADA (SPAIN)

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In Portugal winter tourism is confined to only one mountain called Serra da Estrela. Many Portuguese engage on ski holidays in Spain. The Spanish mountain where more Portuguese skiers go is called Sierra Nevada (Cetursa, 2010). In Europe most of the countries use the same colours to classify the level of the difficulty of the ski slopes. The aim of this paper is to compare the level of the difficulty attributed by the colours of the ski slopes in the Portuguese mountain of Serra da Estrela and the Spanish mountain of Sierra Nevada.

**Keywords:** Winter tourism, Ski, Ski slope, Difficulty, Security.

### Introduction

In the last 15 years snow tourism in Portugal has been suffering a significant increase. As such, new challenges are now a reality if one wants to see the potential of snow tourism recognised in Portugal. In order for this to happen there is a need to improve already existing facilities as well as review safety procedures and conditions. It is common knowledge that a ski resort sees its difficulty level defined by its trail colours (ATUDEN,2003; SNOSM,2009). Ski trail ratings are essential for safety – a wrong rate might mislead the skier and result in serious accidents. It is therefore essential for the rating of ski trails to be a thoroughly process. According to the study performed by the “Cabinet Architecture et Territoire pour le Compte de la Direction du Tourisme” (French Tourism Study Centre for Architecture and Territory), Spain has 328 ski lifts whereas the information from the Portuguese office “Turistrela” mentions only 5 ski lifts in Serra da Estrela (the only place to practise ski in Portugal). Alongside this information it was also possible to state that in Spain, Sierra Nevada is the tourism destination where Portuguese spend more days skiing on a yearly basis. This paper analyses the criteria involved in the rating of ski trails in both the Portuguese and the Spanish ski resorts previously mentioned. Since several skiers have reported that both places do not obey the same rate criteria as far as ski trails were concerned, the need for further study was felt. According to PETUR - Plano Estratégico de Turismo da Serra da Estrela, 2006 (Tourism Strategic Plan for the mountain of Serra da Estrela in Portugal, 2006) it is possible to make three new ski trails in Serra da Estrela which, obviously, need to be rated. To establish such rating slope will be considered. It is our aim to analyse if to similar realities and patterns in both Serra da Estrela and Sierra Nevada the same ratings have been assigned.

## Literature Review

According to study made by “le cabinet Architecture et Territoire pour le compte de la direction du Tourism” in February of 2005, the European leaders in terms of ski slopes machines are France with 4013, Austria with 3111, Switzerland with 2354 and Italy with 2204. In Iberia peninsula we have Spain with 328, Andorra with 104 and Portugal with 5.

Usually skiers are people who care about the environment, the majority of interviewed people (86%) among visitors of the ski-center, is willing to contribute to the environmental protection and conservation. Christopoulou, Papadopoulos (2001).

Many scientists studied the climate changing, for instance Hamilton et al analyzed on their study the average December–March temperature in New Hampshire, in the years 1896–2006. They conclude that the temperature has increased in a Linear trend +2.1 °C in 110 years. Hamilton, Brown, Keimb (2007)

It is very probable that climate change will lower the reliability of snow cover. But The tourism representatives think that climatic change is presented in a highly exaggerated form by the media—and also in science and politics. Elsasser, Bürki, (2002)

The impacts of climate change on snow conditions in ski areas have decreased in recent years, probably owing to the major increase in snowmaking. Töglhofer, Eigner, Pretenthaler, (2011).

When we think about tourism and disasters, as far as tourism is concerned, the so-called “indirect” effects of these disasters have proven to be more important than the direct damages. The former consist mainly of loss of earnings, which can result for example from the closure of access roads. Nöthiger, Elsasser (2004).

According to the “Système National d'Observatoire de la Sécurité en Montagne” (French National Organization for Mountain Security) in 8 million of skiers, in France there was 50.000 interventions, with an average of 1 broken bone by intervention. 15 peoples die in the ski slope because of accidents. If we calculate the percentage, we conclude that 0,625% had an accident and that 0,03% of the accidents finished with someone dead. We can also conclude that 0,0001875% of skiers die because of an accident.

Ski is a sport who involve a certain risk and the ski slopes managers must be aware of the importance of create and maintain the slopes as safe as possible.

There are a lot of ski slopes with a very different difficulty level. It is important that skiers know exactly, which is the difficulty level of the ski slope before they get in it, otherwise skiers might get seriously injured.

According to ATUDEM's - Asociación Turística de Estaciones de Esquí Y Montaña, 2003 (Spanish Tourism Association of Ski Mountain Facilities, 2003) roles in the article 46 it is defined that green ski slope are very easy and its inclination is under 15%. The same Association define that blue ski slope are easy or medium and cannot have an inclination bigger than 25%. The red ski slope is considered difficult and cannot reach an inclination bigger than 45%. Finally if a ski slope have an inclination superior to 45%, it will be considered very difficult and it will be black.

Carvalho(2007) wrote that the ski slopes must have security services with first aid equipment and means to save and rescue skiers. Security must be a basic infrastructure in any ski slope.

The PETUR (2006) also refers the importance of the security on the roads that take the tourists to the mountain.

## Relevance of the Study

In Portugal There is only one mountain where people can go skiing. The name of the mountain is Serra da Estrela, it has about 2000 meters high and the ski slopes are very good for beginners. Many Portuguese start skiing in Serra da Estrela but when they are no longer beginners, they go elsewhere to ski. The several places where Portuguese usually go to are, Serra de Bejar (La Covatilla, 2011), Manzaneda (Manzaneda, 2011), Sierra Nevada (Cetursa, 2010), and Pirineus among others.

Sierra Nevada is the most chosen one by the Portuguese. According to “Dossier de Prensa Temporada 2009-2010” 28.000 Portuguese went to ski at Sierra Nevada. Many Portuguese comment that the level of the difficulty of the colors is more exigent in Sierra Nevada than in Serra da Estrela.

As we saw before it is very important that skiers know the level of difficulty before they get in a ski slope, otherwise they might get seriously injured. But if there is a different difficulty applied to the same color depending on the mountain, this difference might be very dangerous for people who go skiing in both mountains.

The aim of this paper is to verify if the same level of difficulty of the ski slope is applied in the same color in both mountain, Serra da Estrela and Sierra Nevada.

## Method

The method has 3 main parts that must be explained. In the first part we calculate the inclination of the ski slopes, in the second part we join together the ski slopes from Serra da Estrela and Sierra Nevada, and at the third part we calculate the standard deviation and analyze the results.

### Method - Part 1

#### Calculate the inclination of the ski slope

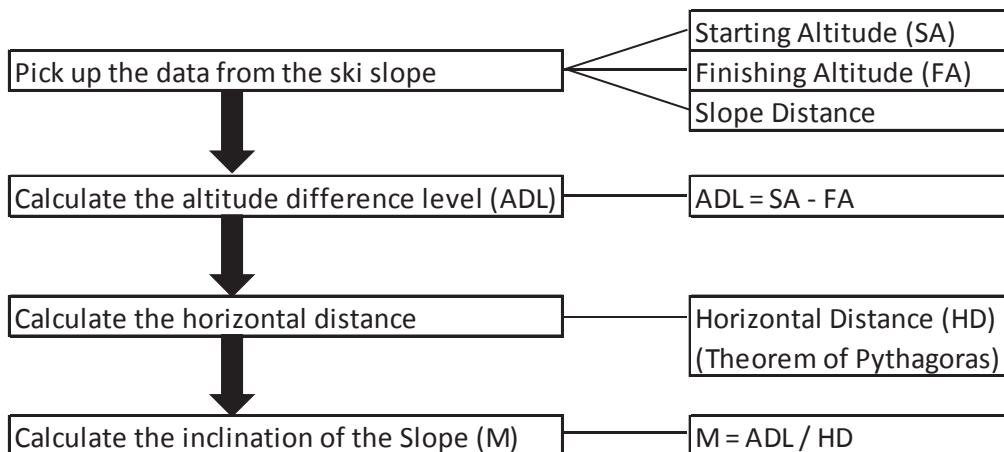


Figure 1. Method Part 1 (own source).

## Method - Part 2

join together the slopes from SE and SN

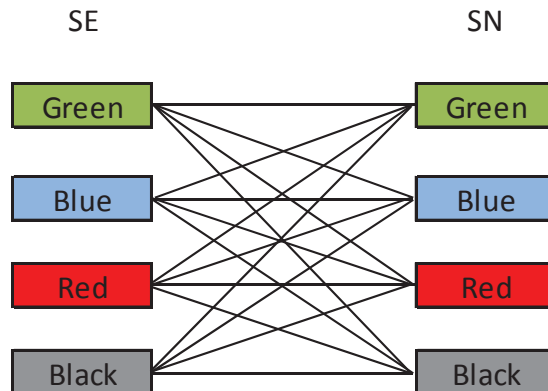


Figure 2. Method Part 2 (own source).

To start we join the green ski slopes from Serra da Estrela with green ski slopes from Sierra Nevada, then we join the green ski slopes from Serra da Estrela with blue ski slopes from Sierra Nevada, then we join the green ski slopes from Serra da Estrela with red ski slopes from Sierra Nevada, then we join the green ski slopes from Serra da Estrela with black ski slopes from Sierra Nevada.

After we join the blue ski slopes from Serra da Estrela with green ski slopes from Sierra Nevada, then we join the blue ski slopes from Serra da Estrela with blue ski slopes from Sierra Nevada, then we join the blue ski slopes from Serra da Estrela with red ski slopes from Sierra Nevada, then we join the blue ski slopes from Serra da Estrela with black ski slopes from Sierra Nevada.

Then this process is repeated to red ski slopes, and then again to black ski slopes.

## Method - Part 3

Calculate and analyse the standard deviation

Calculate the standard deviation of the joint

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{(n-1)}}$$

Analyse the standard deviation

For which join made in part 2 we calculated a standard deviation of the inclination. The join with smaller standard deviation in each color define which color of Sierra Nevada is closer to a certain color of Serra da Estrela.

Using this method we can know if both mountains are using the same criteria to attribute the colors of the ski slopes.

### Limitation of the Study

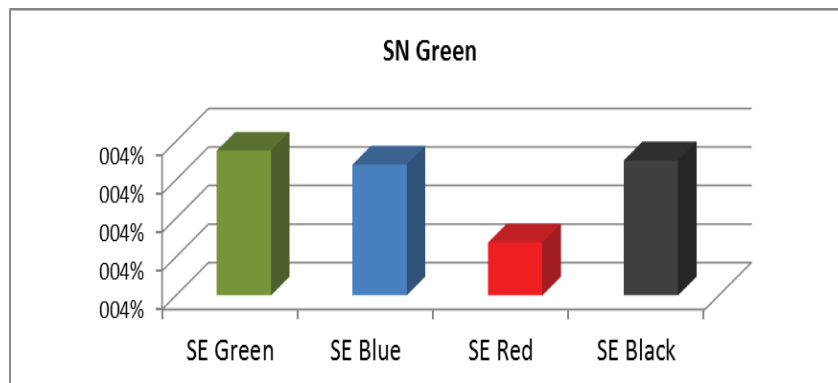
There are other factors than Inclination that can make a ski slope more difficult to ski. Characteristics of the ski slope like being wide or narrow, being plan or having holes, have rocks or tree in the middle, are factors that compromise the difficulty of the ski slope. In this study we only considered the inclination of the ski slope, sending the rest of the factors to a second plan.

In this study we grouped together several inclination of the ski slope organized by colors and applied to them the standard deviation. Other mathematics methods can be used to reach the same conclusions.

The third limitation of the study is that inclination is measured for the entire ski slope. Sometimes a ski slope can be very difficult beside it have a small inclination, because it can have a big inclination in a small part.

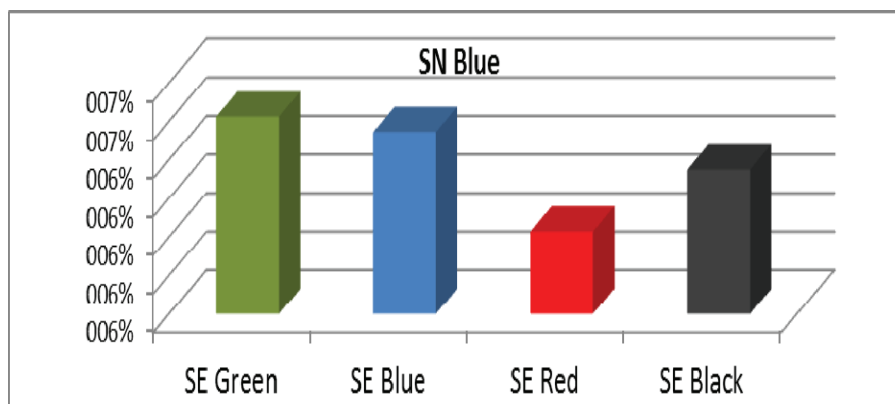
### Results

Analyzing the standard deviation for the green color of Sierra Nevada, we verify that the minimum standard deviation is obtained with the red color of Serra da Estrela.



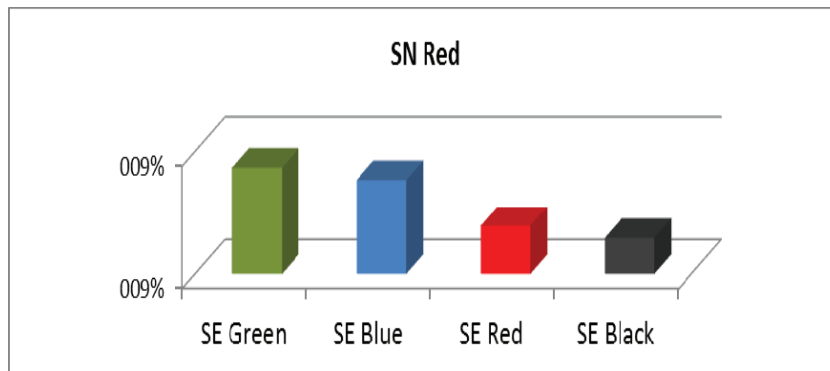
**Figure 3.** Combining SN green with all colors of SE (own source).

Analyzing the standard deviation for the blue color of Sierra Nevada, we verify that the minimum standard deviation is obtained with the red color of Serra da Estrela.



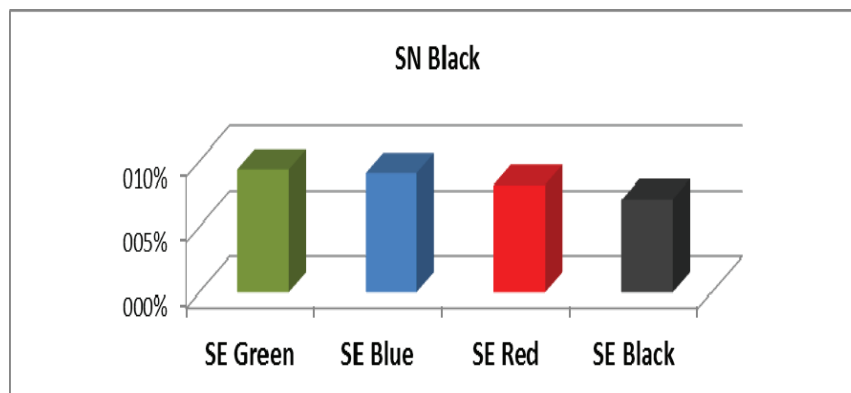
**Figure 4.** Combining SN blue with all colors of SE (own source).

Analyzing the standard deviation for the red color of Sierra Nevada, we verify that the minimum standard deviation is obtained with the black color of Serra da Estrela.



**Figure 5.** Combining SN red with all colors of SE (own source).

Analyzing the standard deviation for the black color of Sierra Nevada, we verify that the minimum standard deviation is obtained with the black color of Serra da Estrela.



**Figure 6.** Combining SN black with all colors of SE (own source).

## Conclusion

As described before, the inclination of the ski slopes have been calculated and grouped together by colors, meaning their difficulty level. Then the colors of a mountain were compared with the colors of the other mountain, based on the inclination, using the minimum standard deviation.

If both mountains had the same difficulty level, the minimum standard deviation of a certain color of a mountain would be the same color in the other mountain. But the results that we obtained tell us a different story.

The minimum standard deviation for green color of Sierra Nevada was obtained with red color of Serra da Estrela. The minimum standard deviation for blue color of Sierra Nevada was obtained with red color of Serra da Estrela. The minimum standard deviation for red color of Sierra Nevada was obtained with black color of Serra da Estrela. Finally the minimum standard deviation for black color of Sierra Nevada was obtained with black color of Serra da Estrela.

We conclude that Serra da Estrela and Sierra Nevada use different criteria to apply the colors of the ski slopes. As we affirm before, this can be very dangerous to skiers that practice ski in both mountains.

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